Claims

1. Method for in-line preparation of liquid for an extracorporeal blood treatment apparatus,
which apparatus comprises at least one fluid path from a liquid source to a region for injecting said liquid into an extracorporeal blood circuit and/or into a cardiovascular system of a patient and/or into a chamber of a dialyser, at least a first and a second filtration station placed along said fluid path, the second filtration station operating downstream of the first filtration station,
said method comprising the steps of :

a) placing a filter in correspondence with each station ;

b) sending liquid along said fluid path through said first and said second filtration stations towards said injection region;

c) removing the filter which operates in correspondence with the first filtration station ;

d) placing, in correspondence with the first station , the filter which operates in correspondence with the second filtration station; and

e) placing a new filter in correspondence with the second station

2. Method according to Claim 1, wherein the phases a), b), c), d), e) follow one another over time.

3. Method according to Claim 1, wherein after said phase of placing a new filter, provision is made to repeat the phases b), c), d), e) in succession one after another.

4. Method according to Claim 1, wherein each phase b) during which the fluid is sent to said injection region corresponds to the administration of an extracorporeal treatment to a patient by said apparatus, the phases

c), d), e) being carried out once the treatment is finished.

5. Method according to Claim 1, wherein each phase b) during which the liquid is sent to said injection region corresponds to a predetermined interval of time.

6. Method according to Claim 1, wherein each phase b) during which the fluid is sent to said injection region corresponds to an interval of time which can be programmed by a user.

7. Method according to Claim 2, wherein between said phases b) and c), a phase interrupting the flow of liquid along said path is provided.

8. Method according to Claim 2, wherein between said phases c) and d), the following subphases are provided :

- isolating the filter of said second station from said passage of fluid;
- carrying out an operation of disinfecting said fluid path without acting on the filter present in said second station

9. Method according to Claim 1, wherein the filters operating in said first and in said second station are structurally identical to each other.

10. Method according to Claim 1, wherein a sterile filter is placed in correspondence with said second station, in order to define a barrier capable of guaranteeing the sterility of the liquid downstream of said second station, in use.

11. Method according to Claim 1, wherein each one of said filters comprises at least a first and a second chamber separated from each other by a filtration membrane , at least one opening for access to said

first chamber and at least one outlet opening of said second chamber.

12. Method according to Claim 11, wherein said fluid path comprises:

a first part arranged to connect the liquid source to the first chamber of the filter which operates in said first station,

a second part arranged to connect the second chamber of the filter operating in said first station to the first filter chamber operating in said second station,

a third part arranged to connect the second chamber of the filter operating in said second station with said injection region.

13. Method according to Claim 11, wherein each filter also comprises an outlet opening in correspondence with said first chamber, in order to transfer fluid in said first chamber of the filter tangentially to the filtration membrane .

14. Method according to Claim 13, wherein said tangential displacement phase is carried out periodically.

15. Method according to Claim 13, wherein said tangential displacement phase is carried out continuously.

16. Device for in-line preparation of liquid comprising:

a fluid path from a liquid source to a region for injecting said liquid into an extracorporeal blood circuit and/or into the cardiovascular system of a patient and/or into a chamber of a dialyser;

means for determining movement of the liquid along said path;

at least a first and a second filtration station placed along said fluid path, the second filtration station operating downstream of said first filtration station;

a filter operating in correspondence with each filtration station;

a transfer unit acting at least on the filter which operates in correspondence with said second station in order to transfer this filter from said second station to said first station.

17. Device according to Claim 16, wherein said transfer unit further acts on the filter which operates in said first station in order to determine its removal from said first station.

18. Device according to Claim 16, wherein it comprises a control unit which acts on said transfer unit and is capable of executing the operations below:

activating said means in order to determine the movement of the liquid along said path during one liquid preparation session;

when the preparation session is finished, controlling said transfer unit so that it brings the filter operating in the first station into the discharge station and so that it brings the filter present in the second station into the first station.

19. Device according to Claim 16, wherein the filter present in said second station is sterile.

20. Device according to Claim 18, comprising sensors associated with said first and with said second station in order to indicate the presence of a filter and to send a corresponding signal to the control unit.

21. Device according to Claim 18, comprising detectors associated with said first and with said second station in order to indicate the identity of a filter placed in

each of said stations and to send a corresponding signal to the control unit.

22. Device according to Claim 20, wherein the control unit is programmed in order to allow the in-line preparation of liquid if the sensors indicate the presence of said filters in the respective stations.

23. Device according to Claim 21, wherein the control unit is programmed in order to allow the in-line preparation of liquid if the detectors indicate that a filter, which has only been used for a single previous session or a new filter is used in the first station and that a new filter is used in the second station.

24. Device according to Claim 16, wherein each filter has at least a first and a second chamber separated from each other by a filtration membrane , at least one opening for access to said first chamber and at least one outlet opening of said second chamber.

25. Device according to Claim 18, wherein said fluid path comprises:

a first part arranged to connect the liquid source to the first chamber of the filter which operates in said first station,

a second part arranged to connect the second chamber of the filter operating in said first station to the first chamber of the filter operating in said second station, and

a third part arranged to connect the second chamber of the filter operating in said second station to said injection region.

26. Device according to Claim 23, wherein each filter also comprises an outlet opening in correspondence with said first chamber in order to carry out, periodically or continuously, a transfer of fluid from the first

chamber of the filter, tangential to the filtration membrane.

27. Apparatus for extracorporeal blood treatment, comprising:

at least one device for in-line liquid preparation according to one of the preceding claims, and

at least one blood treatment unit having a first chamber and a second chamber separated by at least one semipermeable membrane, the first chamber having at least one outlet opening suitable of being connected to a discharge line and the second chamber being suitable for connection to an extracorporeal blood circuit .

28. Apparatus according to Claim 27, wherein said region for injecting said liquid is connected to the extracorporeal blood circuit upstream and/or downstream of the treatment unit .

29. Apparatus according to Claim 27, wherein said region for injecting said liquid is connected to said first chamber of the unit .